03-08-00

A

Attorney's Docket No.: U 012642-4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of Inventors:

1. PAAL E. HAUGSETH
2. HELGE SIMONSEN

WARNING: *The Declaration must name all of the actual inventor(s).*

For (title):
A COMPUTER NETWORK CONTROLLER

1. Type of Application

This new application is for a(n) (check one applicable item below):

- ☑ Original (nonprovisional)
- ☐ Design
- ☐ Plant

WARNING: ***Do not*** *use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4) unless the International Application is being filed as a divisional, continuation or continuation-in-part application.*

WARNING: ***Do not*** *use this transmittal for the filing of a provisional application.*

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this date **MARCH 7, 2000 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EL386267823US addressed to the: Assistant Commissioner of Patents, Washington, D.C. 20231**

GERALDINE MARTI
(type or print name of person mailing paper)

Geraldine Marti
(Signature of person mailing paper)

NOTE: ***Each paper or fee referred to as enclosed herein has the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 CFR 1.10(b).***

WARNING: ***Certificate of mailing (first class) or facsimile transmission procedures of 37 CFR 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.***

2. Benefit of Prior U.S. Application(s) (35 U.S.C. 119(e), 120, or 121)

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: *If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.*

WARNING: *When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional **must** be filed prior to the Saturday, Sunday or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).*

☐ The new application being transmitted claims the benefit of prior U.S. application(s) and enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

☐ Divisional.

☐ Continuation.

☐ Continuation-in-Part (C-I-P).

3. Papers Enclosed That Are Required For Filing Date Under 37 CFR 1.53 (Regular) or 37 CFR 1.153 (Design) Application

11 Pages of specification

3 Pages of claims

1 Pages of Abstract

5 Sheets of drawing

☑ formal

☐ informal

WARNING: ***DO NOT*** *submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).*

NOTE: "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (⅝ inch) down from the top of the page." 37 C.F.R. 1.84(c).

(complete the following, if applicable)

☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)". 37 C.F.R. 1.84(b).

4. Additional papers enclosed

- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 CFR 1.98)
- ☐ Form PTO-1449
- ☐ Citations
- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath

- ☑ Enclosed

  executed by *(check **all** applicable boxes)*

  - ☑ inventors.
  - ☐ legal representative of inventors. 37 CFR 1.42 or 1.43
  - ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.
    - ☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. *See item 13 below for fee.*
- ☐ Not Enclosed.

WARNING: *Where the filing is a completion in the U.S. of an International Application but where a declaration is not available or where the completion of the U.S. application contains subject matter in addition to the International Application the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.*

- ☐ Application is made by a person authorized under 37 CFR 1.41(c) on behalf of *all the above named inventors.* (The declaration or oath, along with the surcharge required by 37 CFR 1.16(e) can be filed subsequently).

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

- ☐ Showing that the filing is authorized. *(Not required unless called into question. 37 CFR 1.41(d).)*

6. Inventorship Statement

WARNING: *If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.*

The inventorship for all the claims in this application are:

- ☐ The same
- ☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of $130.00 required by 37 CFR

1.17(k) is required to be filed with the application or within such time as may be set by the Office. 37 CFR 1.52(d).

NOTE: A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b).

☑ English

☐ non-English

☐ the attached translation is a verified translation. 37 CFR 1.52(d).

8. Assignment

☑ An assignment of the invention to DOLPHIN INTERCONNECT SOLUTIONS AS

☑ is attached. A separate ☑ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

☐ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: *A newly executed "CERTIFICATE UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993. 1150 O.G. 62-64.*

9. Certified Copy

Certified copy of application

Country	Appln. No.	Filed

from which priority is claimed

☐ is attached.

☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 CFR 1.16)

A. ☑ Regular Application

Claims as Filed

Number Filed			Number Extra			Rate	Basic Fee 37 CFR 1.16(a) $690.00
Total Claims (37 CFR 1.16(c))	7	- 20 =	0	x	$	18.00	
Independent Claims (37 CFR 1.16(b))	1	- 3 =	0	x	$	78.00	
Multiple dependent claim(s), if any (37 CFR 1.16(d))				+	$	260.00	

☐ Amendment cancelling extra claims enclosed.

☐ Amendment deleting multiple-dependencies enclosed.

☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation $ 690.00

B. ☐ Design application ($310.00 — 37 CFR 1.16(f))

Filing Fee Calculation $

C. ☐ Plant application ($480.00 — 37 CFR 1.16(g))

Filing Fee Calculation $

11. Small Entity Statement(s)

☑ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is(are) attached or has been filed.

Filing Fee Calculation (50% of **A**, **B** or **C** above) $ 345.00

NOTE: Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. 37 CFR 1.28(a).

12. Request for International-Type Search (37 CFR 1.104(d)) *(Complete, if applicable)*

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made At This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time. *(This and the surcharge required by 37 CFR 1.16(e) can be paid subsequently.)*

☑ Enclosed

☑ basic filing fee $ 345.00

☑ Recording assignment
($40.00; 37 CFR 1.21(h)) (See attached "COVER SHEET FOR ASSIGNMENT ACCOMPANYING NEW APPLICATION.")

☐ Petition fee for filing by other than all the inventors or person on behalf of the inventor where inventor refused to sign or cannot be reached.
($130.00; 37 CFR 1.47 and 1.17(h)) $

☐ For processing an application with a specification in a non-English language.
($130.00; 37 CFR 1.52(d) and 1.17(k)) $

☐ Processing and retention fee
($130.00; 37 CFR 1.53(d) and 1.21(l))

☐ Fee for international-type search report
($40.00; 37 CFR 1.21(e)). $

NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application which is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid or the processing and retention fee of §1.21(l) must be paid within 1 year from notification under §53(d).

Total fees enclosed $ 345.00

14. Method of Payment of Fees

☑ Check in the amount of $ 345.00

☐ Charge Account No. 12-0425 in the amount of $

A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: *If no fees are to be paid on filing, the following items should not be completed.*

WARNING: *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.*

☑ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 12-0425.

☑ 37 CFR 1.16(a), (f) or (g) (filing fees)

☐ 37 CFR 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☐ 37 CFR 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☑ 37 CFR 1.17 (application processing fees)

WARNING: *While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under §1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to no avail unless a request or petition for extension is filed." (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27)*

☑ 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 CFR 1.311(b))

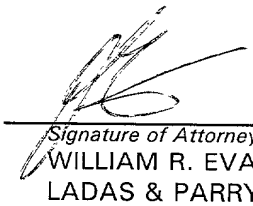
NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).

NOTE: 37 CFR 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application ... prior to paying, or at the time of paying, ... issue fee". From the wording of 37 CFR 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

16. Instructions As To Overpayment

☑ credit Account No. 12-0425

☐ refund



Signature of Attorney

WILLIAM R. EVANS
LADAS & PARRY
26 WEST 61ST STREET
NEW YORK, NEW YORK 10023

Reg. No.25,858

Tel. No.(212)708-1930

☑ **Incorporation by reference of added pages**

(Check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added ___

☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added ___

☑ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added 4

☐ **Statement Where No Further Pages Added**

(If no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item:)

☐ This transmittal ends with this page.

Practitioner's Docket No. U 012642-4 ***PATENT***

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

[ ] In re application of:
Application No.: Group No.:
Filed: Examiner:
For:

[ ] *Patent No.: Issue Date:

*NOTE: *Insert name(s) of inventor(s) and title also for patent Where statement is with respect to a maintenance fee payment, also insert application number and filing date, and add Box M. Fee to address.*

STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(c-f) and 1.27(b-d))

With respect to the invention described in
[ ] the specification filed herewith.
[ ] application no. _____, filed _____.
[ ] patent no. _____ issued _____.

I. IDENTIFICATION AND RIGHTS AS A SMALL ENTITY

I hereby state that I am

(complete either (a), (b), (c) or (d) below)

(a) Independent Inventor
[ ] a below named independent inventor, and that I qualify as an independent inventor, as defined in 37 CFR 1.9(c), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office.

(b) Noninventor Supporting a Claim by Another
[ ] making this statement to support a claim by

_____

for a small entity status for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, I hereby state that I would qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, if I had made the above identified invention.

(c) Small Business Concern
[ ] the owner of the small business concern identified below:
[X] an official of the small business concern empowered to act on behalf of the concern identified below:

Name of Concern DOLPHIN INTERCONNECT SOLUTIONS AS
Address of Concern P.O.Box 70 Bogerud, N-0621 Oslo, Norway

and that the above identified small business concern qualifies as a small business concern, as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

(d) Non-Profit Organization

[ ] an official empowered to act on behalf of the nonprofit organization identified below:

Name of Organization _____
Address of Organization _____

TYPE OF ORGANIZATION

[ ] University or Other Institution of Higher Education
[ ] Tax Exempt Under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3))

[ ] Nonprofit Scientific or Educational Under Statute of State of the United States of America
(Name of State_____)
(Citation of Statute_____)

[ ] Would Qualify as Tax Exempt Under Internal Revenue Service Code (26 USC 501(a) and 501(c) (3)), if Located in the United States of America

[ ] Would Qualify as Nonprofit Scientific or Educational Under Statute of State of the United States of America, if Located in the United States of America
(Name of State_____)
(Citation of Statute_____)

and that the nonprofit organization identified above qualifies as a nonprofit organization, as defined in 37 CFR 1.9(e), for purposes of paying reduced fees under Sections 41(a) and (b) of Title 35, United States Code.

II. OWNERSHIP OF INVENTION BY DECLARANT

I hereby state that rights under contract or law remain with and/or have been conveyed to the above identified

[ ] person	[ ] concern	[ ] organization
(item (a) or (b) above)	(item (c) above)	(item (d) above)

EXCEPT, that if the rights held are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held (1) by any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, (2) any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or (3) a nonprofit organization under 37 CFR 1.9(e).

[ ] no such person, concern, or organization
[ ] person, concerns or organizations listed below*

*NOTE: *Separate statements are required from each named person, concern or organization having rights to the invention as to their status as small entities. (37 CFR 1.27)*

Full Name _____
Address _____
[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

Full Name _____
Address _____
[ ] INDIVIDUAL [ ] SMALL BUSINESS CONCERN [ ] NONPROFIT ORGANIZATION

III. ACKNOWLEDGEMENT OF DUTY TO NOTIFY PTO OF STATUS CHANGE

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

IV. DECLARATION

(check the following item, if desired)

NOTE: The following verification statement need not be made in accordance with the rules published on October 10, 1997, 62 Fed. Reg. 52131, effective December 1, 1997.

NOTE: "The presentation to the Office (whether by signing, filing, submitting, or later advocating) of any paper by a party, whether a practitioner or non-practitioner, constitutes a certification under § 10.18(b) of this chapter. Violations of § 10.18(b)(2) of this chapter by a party, whether a practitioner or non-practitioner, may result in the imposition of sanctions under § 10.18(c) of this chapter. Any practitioner violating § 10.18(b) may also be subject to disciplinary action. See §§ 10.18(d) and 10.23(c)(15)." 37 CFR 1.4(d)(2).

[ ] I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

V. SIGNATURES

(complete only (e) or (f) below)

(e)
NOTE: All inventors must sign the statement.

_____
Name of Inventor

_____ Date: _____
Signature of Inventor

_____
Name of Inventor

_____ Date: _____
Signature of Inventor

_____
Name of Inventor

_____ Date: _____
Signature of Inventor

(add lines for any additional inventors who must sign)

or

(f)
NOTE: The title of the person signing on behalf of a concern or nonprofit organization should be specified.

Name of Person Signing X KÅRE LOCHSEN

Title of Person X CEO
(if signing on behalf of a concern or non-profit organization)

Address of Person Signing OLAF HEUSETS VEI 6, DOLPHIN INTERCONNECT
NO-0621 OSLO, NORWAY

SIGNATURE [signature] DATE 16 FEB 2000

A Computer Network Controller

Background for the Invention

The present invention relates generally to the field of computer networks, and in particular to a general computer network controller and a method for local and remote asynchronous completion control in a system area network.

Most existing high-performance network controllers have to be managed by the operating system or by kernel agents in order to guarantee protected accesses across different nodes. Users have to do system calls to remote memory through high latency programming interfaces. In addition, explicit synchronization and completion control decreases the sustained bandwidth between users. These problems are described in "An Implementation and Analysis of the Virtual Interface Architecture", *http://www.berkeley.edu/~philipb/via/sc98/paper/index.htm.*

Communication between network controllers in a system area network (SAN) is handled by switching fabrics and point-to-point links. Among the situations which create network congestion are, i) a failured network component, ii) a high-performance node sending packets into a low-performance node, iii) several nodes sending data packets to one particular node (thus creating a hot-node). If such a congestion problem is not handled properly, network throughput will be reduced.

US patent no. 5,613,071 (Rankin et al.) discloses a method and an apparatus for providing remote memory access in a distributed memory multi-processor system.

Further, US patent no. 5,915,088 (Basavaiah et al.) discloses a multi-processor system that is configured so that each CPU of the system has access to at least portions of the memory of any other CPU.

These two patents describe a more general way of doing RMA with address mapping which has been available for some time. They do not refer to any implementation issues or method of optimization.

Particularly in a SAN network, it is important to find a method of scheduling

packets based on e.g. priorities, control messages, data messages, and to avoid congestion. Also, when managing virtual channels (virtual channels are described more fully in co-pending US patent application no. ... , "Virtual channel flow control...", assigned to the assignee of the present application, the relevant disclosures of which co-pending application are incorporated herein by reference), a solution must be found regarding the problem of providing a method of reacting to the flow control information provided by the SAN layer.

Generally, a network controller forwards packets to the attached bus as they arrive from the network. That is, the bus to which the network controller is attached, may not necessarily be utilized to its optimum. This leads to a possible problem of decreased bandwidth.

Summary of the invention

The computer network controller of the present invention solves or at least alleviates the problems of the prior art as stated above. The network controller of the present invention solves or alleviates the congestion problem by its inherent ability to do implicit fabric rate injection control. The network controller of the present invention also solves or alleviates the problem of reacting to flow control information from a link layer, by having the ability to schedule packets onto different virtual channels depending on congestion information received from the switching fabric. Furthermore, in order to utilize an attached bus to its optimum, the network controller of the present invention decouples the data packet size in the network from the packet size of the bus to which the network controller is attached. Furthermore, the network controller of the invention processes tasks in parallel in order to meet the required bandwidth from both front-end and back-end buses.

Thus, in the most general embodiment of a first aspect of the present invention, there is provided a general computer network controller, preferably operative in a System Area Network, which network controller includes a data buffer handling payload as well as a dedicated, programmable micro sequencer handling control flow and being capable of running different network packets and

protocols, being packet format independent and network independent. The programmable micro sequencer is tightly coupled to a fully associative context block for control thereof, and the context block is operative to hold a number of last recently used contexts to provide a dynamic resource allocation scheme reflecting run time situations. Substantial parts of the contexts are updated by the micro sequencer, by an inbound scheduler and by a network protocol engine.

Preferably, the micro sequencer is operative to control a scalable memory array which can be used as a table for inbound address mapping of registered memory and access protection, and as a means for keeping context information about all active channels.

In a preferred embodiment of the invention, the fully associative context block constitutes a connection between the inbound scheduler and the network protocol engine, thereby giving the network controller the ability to pipeline tasks and execute in parallel.

In the same preferred embodiment, the context block may also be operative to have contexts dynamically allocated between inbound Remote Direct Memory Access (RDMA), inbound Remote Memory Access (RMA) and outbound RMA, two upper contexts nevertheless being reserved for locally driven remote direct memory access, while the context block contains information including the following:

- expected sequence number of next packet for checking,
- input gathering size in order to optimize use of an attached bus,
- packet type defined by the network for a specific virtual channel,
- accumulated packet cyclic redundancy check for data integrity,
- source addresses,
- destination addresses,
- mapping for RDMA operations,
- dedicated flags like page crossing to do new mapping,
- word count zero detection,
- as well as protection tag check,

all of these information events from the inbound scheduler, the micro sequencer and the network protocol engine to be synchronized by the context block and

used by the micro sequencer to invoke, restart, switch or terminate a thread immediately.

In another embodiment of the invention, the micro sequencer is operative to control the network protocol engine which in its turn is operative to perform injection control, based on feedback from a link layer as well as intervention from an operative system. The network protocol engine is then operative to schedule packets to the network.

In this embodiment, the network protocol engine may further be informed about onto which virtual or physical lane packets are going to be sent, and it may also utilize the capability of the data buffer and transmit up to four packets from different tasks simultaneously, namely a request and a response to the network and a request and a response to an attached bus.

In a further embodiment of the first aspect of the invention, the inbound scheduler is operative to decode, schedule and invoke running tasks or allocate new tasks, based on

i) packets received from the network,

ii) memory mapped operation received from a bus attachment module,

iii) descriptors inserted in work queue fifos by a user application, and

iv) tasks received from the context block.

In another aspect of the present invention, there is provided a method for local and remote asynchronous completion control, for use in a System Area Network. The System Area Network comprises a plurality of host channel adapters, a plurality of target channel adapters and a switching fabric, and each respective one of the adapters is constituted by a computer network controller of the type as defined above in the most general embodiment stated, together with a bus attachment module and a network interface. In the method of the invention, message cyclic redundancy check as well as an address to a remote completion queue, e.g. at a target, are attached, by such a micro sequencer, to a last packet in a message to be sent from a sender, e.g. a host, to a receiver, e.g. a target. Thereby, on reception of the last packet at the receiver and checking for data integrity for the whole message transfer by a target micro sequencer, "receipt complete" can be signaled directly from the target micro sequencer in the remote

process completion queue, and simultaneously a response is made back to the sender. The sender will then signal "send complete" and status directly to a local process.

As appears from the above, the present invention provides apparatus and a method for implementation of a "network protocol engine", i.e. a network controller, for use particularly, but not only, in SAN networks, in particular HCA (host channel adapters) and TCA (target channel adapters). In a SAN it is then referred to an SPE, i.e. a SAN Protocol Engine.

The present invention is based on a programmable Multi-Context Micro Sequencer (MCMS), running dedicated instructions optimized for network protocols. A dynamic resource allocation scheme reflects the runtime situations by keeping the most recently used tasks in a Fully Associative Context Block (FACB). In connection with the micro sequencer is a configurable memory array used for inbound address mapping and access protection, and keeping context information of all the active channels not currently present in the FACB. Associated with the MCMS is a Data Buffer with a number of read and write ports. This enables the SPE to run different tasks in parallel. Attached to the MCMS is a Network Protocol Engine (NPE), scheduling packets based on i) congestion information provided by the layer flow control, ii) knowledge of the SAN topology (i.e. injection rate control), iii) priorities of packets.

The network controller of the present invention is capable of running multiple protected user-level RDMA with implicit completion control.

The SPE is independent of network packet length. Packet length is programmable in order to improve bus bandwidth by doing input gathering, and the SPE can therefore optimize the use of the attached buses.

Brief description of the drawings

The above and further advantages may be more fully understood by referring to the following exemplary description of embodiments, in conjunction with the accompanying drawings of which:

Figure 1 presents an overview of a System Area Network.

Figure 2 presents a general purpose network packet.

Figure 3 presents a block diagram of a general HCA/TCA including a SPE.

Figure 4 presents a detailed block diagram of an SPE in accordance with a preferred embodiment of the invention.

Figure 5 illustrates Local and Remote Completion Control in accordance with a preferred embodiment of another aspect of the invention.

Detailed description

The computer network controller of the present invention can be applied in any computer network (a LAN, a SAN), but it exhibits characteristics that make it particularly well suited for use in a System Area Network (SAN). The embodiments described in the following will refer to a SAN application. Also in the following, the term SAN Protocol Engine (SPE) will be used as a synonym for "computer network controller".

A System Area Network (SAN) 1 is depicted in Figure 1. A SAN is a network which interconnects a plurality of computers (hosts) 2 and a plurality of IO-devices 8, and/or IO-subsystems. This enables Inter-Processor Communication (IPC) (or clustering), host-to-peer (IO) communication, and peer-to-peer communication, over the same network. The host SAN access point is called a Host Channel Adapter (HCA) 6, while the peer SAN access point is called the Target Channel Adapter (TCA) 3. Interconnection between HCAs and/or TCAs is handled by high-performance point-to-point links 5 and switching fabrics 4. Communication between HCAs and/or TCAs is either achieved by sending messages, or by doing memory-mapped communication (e.g. DMA , Direct Memory Access) and/or Programmed-IO (PIO) from a local node to a remote node. Usually the following transfer models are supported:

- Acknowledged connection-oriented
- Unacknowledged connection-oriented
- Unacknowledged connection-less

All transfer methods are based on partitioning data into network packets by a SPE. A data packet 7 is shown in fig. 2, and is constituted by a packet header 12, a payload part 14 and a packet trailer 11. Each packet header 12 contains at least i) a destination address (Destination ID) 13 describing the network address of the packet's destination and to be used by the switching fabric 4 to route the packet 7 to the correct destination, ii) a source address 15 describing the network address of the sender of the packet, iii) a command 17, describing the function the receiver of the packet should perform, and iv) a sequence number 18. If the packet contains data (payload), an address notification 16 is required, so the receiver will know where to put the data.

Each packet trailer 11 is required to have an error-detecting code, usually a cyclic-redundancy check (CRC), to secure data integrity of the complete packet.

Packets are always received in the order they were sent, i.e. the switching fabric 4 does not re-order packets during normal operation.

Fig. 3 shows a simplified block diagram of a general HCA/TCA 3, 6, and indicates on respective sides of a SAN Protocol Engine (SPE) 20 a Bus Attachment Module (BAM) 19 and a network interface 21, connected to another network unit through a bi-directional point-to-point link 5.

A block diagram of an embodiment of the present invention is shown in Figure 4. As mentioned with respect to fig. 3, the SPE interface to the host bus or peer bus is referred to as the Bus Attachment Module (BAM) 19. The SPE interface 21 to the network is referred to as the network layer.

The present invention uses an inbound scheduler 22 to decode, schedule and invoke currently running tasks or allocate new tasks, based on i) packets received from the network, ii) memory mapped operations received from the BAM 19, iii) descriptors inserted in work queue fifos 23 by the user application, and iv) tasks received from a fully associative context block (FACB) 24. The inbound scheduler 22 invokes a multi-context micro-sequencer (MCMS) 25 by a special set of instructions.

The present invention supports the concept defined in the Infiniband

Architecture scheduled to be released mid 2000. That means that messages and DMA transfers can be managed directly between users without intervention from the system kernel. In practice this means that user address space on one node is mapped directly to user space on a remote node. Infiniband defines a set of channels with fixed mapping between local and remote memory.

An Address Translation Table (ATT) contained in a block 26 is setup once by the kernel agents (device drivers) on both sides of the connection, when the memory is registered. Unique contiguous address space is then exported to the users, and is used as reference. This means that the HCA/TCA has the notation of both local physical memory and the virtual remote memory through its inbound and outbound mapping tables, and remote traffic is managed from a set of chained descriptors set up directly by users. Block 26 is a configurable memory array that is used for inbound address mapping and inbound/outbound access protection. Additionally, block 26 keeps context information of all active channels that are not currently present in the FACB 24. Memory array 26 is controlled and updated by micro sequencer 25.

The ATT size is programmable, and depends on the number of Queue Pairs (QP) supported, and number of bits per Protection Tag (PTag). E.g. an ATT with 1M entries and 16-bit PTag may have 64k Channels. The ATT is accessed for new tasks or when page crossing occurs during RDMA.

The work queue fifos 23 contain adresses and protection tags of descriptors inserted directly by the user or kernel agent. The present invention is, however, not limited to the use of these fifos. They are merely used as an illustration on how communication between the SPE and user application may be performed.

In the preferred embodiment of the present invention, a FACB24 is used to hold e.g. the 16 last recently used contexts. The two upper contexts are reserved for locally driven RDMA, while the other 14 are then dynamically allocated between inbound RDMA, inbound RMA and outbound RMA. The context block 24 contains source addresses (SourceID) and destination addresses (destinationID) and mapping for RDMA operations, dedicated flags like page crossing in order to

do new mapping, word count zero detection, data buffer management and integrity check, events like sequence error, protection tag check. The FACB synchronizes all these events from The Inbound Scheduler 22, the Multi-context Micro Sequencer 25 and a Network Protocol Engine 27 (that executes the function of a link-dependent packet sender and outbound scheduler), so that threads are invoked, restarted, switched or terminated immediately.

The Multi-context Micro Sequencer 25 is optimized for running network related instructions. The MCMS itself is packet and network independent.

The SPE 20 can, in the embodiment under discussion, process up to 8 separate data paths simultaneously (4 data paths default). The MCMS handles the control flow, while a data buffer 28 handles the payload. Both units execute independently. The data buffer 28 contains up to 4 write ports and 4 read ports, for high-efficient data movement. The number of entries is equal to the number of FACB entries. The width is programmable. RMDA has dedicated output buffers for efficient pipelining.

The MCMS 25 detects and flags immediately (1 cycle) special events like page boundary crossing, word-count-zero and different error conditions. New tasks are invoked with minimum delay, while task switching is performed in 2 cycles.

The MCMS can be programmed to gather packets received from the network (Input gathering). Thus, the present invention can therefore optimize the use of the attached bus19.

The MCMS 25 performs on-the-fly data integrity check. Messages can be checked either on each page boundary or at the end of the message. Individual packets are checked by the link layer level. In case of an acknowledged connection-oriented transfer model, a negative acknowledge packet is returned to the sender if the data was checked to be incorrect. If a sender (i.e. network controller) does not receive an acknowledge packet within a fixed time period (watchdog timeout), the transfer is marked unsuccessful and the SPE will have to re-transmit the packet(s).

In case the MCMS receives a negative acknowledgement it will re-transmit

the packet.

The MCMS provides integrated local and remote completion. The last packet sent in a message contains both the accumulated message CRC and completion control. The SPE on the receiving HCA/TCA side can therefore signal "receive complete" directly in the remote process's Completion Queue (CQ), and simultaneously respond to the initiator (sender), by sending an acknowledge packet. Upon receiving an acknowledge response, the initiator then signals "send complete" to the local process. No explicit synchronization is needed. The user on the remote side can decide whether to poll the transaction status locally, or being invoked by interrupt. The completion control can be described in the following scenario, while referring to fig. 5.

a) The FACB 24 on local side detects that word count is zero, and flags this immediately to the Host MCMS. The MCMS then extracts the accumulated message CRC and the Remote completion Queue address from the RDMA context, dispatches a "last" packet to the Transmitter, and switches context

b) When the remote side detects such a packet, the remote FACB checks the accumulated CRC and invokes the associated context. The remote MCMS checks the flag, writes status to the CQ 29 and switches context.

c) When the "write response" returns from the BAM, the context is invoked again and the MCMS sends a response back to the host node, and terminates the context.

d) When this response arrives at the host node, "send complete"and status are written to the channel's completion queue, and the context is terminated.

This scheme will reduce almost all protocol overhead, and sustained user throughput will increase dramatically.

As previously mentioned, the present invention uses a Network Protocol Engine 27 to schedule packets to be sent onto the network. The NPE scheduler is capable of link injection control, based on feedback from the link layer 21.

The SPE may transmit up to four packets from different tasks simultaneously, a request and a response to the network, and the same to the

attached bus, processing 32 bytes pr. cycle (64 bytes with 128-bit wide data paths).

In the above description, reference has been made to an embodiment of the invention particularly as depicted in the appended drawings. However, it will be appreciated that various modifications and alterations might be made by persons skilled in the art without departing from the spirit and scope of the present invention. The scope of the invention should therefore only be restricted by the claims that follow, or equivalents thereof.

CLAIMS

1. A general computer network controller, preferably operative in a system area network, said controller including a data buffer handling payload and a dedicated, programmable micro sequencer handling control flow and being capable of running different network packets and protocols, being packet format independent and network independent, wherein said micro sequencer is tightly coupled to a fully associative context block for control thereof, said context block being operative to hold a number of last recently used contexts to provide a dynamic resource allocation scheme reflecting run time situations, substantial parts of said contexts being updated by said micro sequencer, by an inbound scheduler and by a network protocol engine.

2. The computer network controller of claim 1, wherein said micro sequencer is operative to control a scalable memory array which can be used as a table for inbound address mapping of registered memory and access protection, and as a means for keeping context information about all active channels.

3. The computer network controller of claim 1, wherein said fully associative context block constitutes a connection between said inbound scheduler and said network protocol engine, thereby giving said network controller the ability to pipeline tasks and execute in parallel.

4. The computer network controller of claim 3, wherein said context block is operative to have contexts dynamically allocated between inbound remote direct memory access, inbound remote memory access and outbound remote memory access, two upper contexts nevertheless being reserved for locally driven remote direct memory access, said context block containing information including the following:

- expected sequence number of the next packet for sequence checking.
- input gathering size in order to optimize use of an attached bus.
- packet type defined by the network for a specific virtual channel,

- accumulated message cyclic redundancy check for data integrity,
- source addresses,
- destination addresses,
- mapping for remote direct memory access operations,
- dedicated flags like page crossing to do new mapping,
- word count zero detection,
- as well as protection tag check,

all these information events from said inbound scheduler, said micro sequencer and said network protocol engine to be synchronized by said context block and used by said micro sequencer to invoke, restart, switch or terminate a thread immediately.

5. The computer network controller of claim 1, wherein said micro sequencer is operative to control said network protocol engine which in its turn is operative to perform link injection control, based on feedback from a link layer as well as intervention from an operative system, said network protocol engine further being operative to schedule packets to the network.

6. The computer network controller of claim 1, wherein said inbound scheduler is operative to decode, schedule and invoke running tasks or allocate new tasks, based on

i) packets received from the network,
ii) memory mapped operation received from a bus attachment module,
iii) descriptors inserted in work queue fifos by a user application, and
iv) tasks received from said context block.

7. In a system area network comprising a plurality of host channel adapters, a plurality of target channel adapters and a switching fabric, each respective one of said adapters being constituted by a computer network controller of the type defined in claim 1 together with a bus attachment module and a network link interface,

a method for local and remote asynchronous completion control, in which method as well accumulated message cyclic redundancy check as an address to a remote completion queue, e.g. at a target, are attached, by a said micro sequencer, to a last packet in a message to be sent from a sender, e.g. a host, to a receiver, e.g. a target, whereby, on reception of said packet at said receiver and checking for data integrity for the whole message by a target micro sequencer, "receive complete" is signaled directly from said target micro sequencer in the remote process completion queue, and simultaneously a response is made back to the sender, which will then signal "send complete" and status directly to a local process.

Abstract

A computer network controller, preferably operative in a System Area Network (SAN), is described. In a SAN, such a network controller is implemented as a SAN Protocol Engine (SPE) for use in Host Channel Adapters (HCA) and Target Channel Adapters (TCA). The SPE is based on a programmable Multi-Context Micro Sequencer (MCMS) tightly coupled to a fully associative multi-context block (FACB), running dedicated instructions optimized for network protocols. Associated with the MCMS is a Data Buffer with a number of read and write ports. This enables the SPE to run different tasks in parallel. Attached to the MCMS is a link-dependent Packet Sender and Outbound Scheduler hereby called Network Protocol Engine (NPE). The SPE is capable of running multiple user-level RMDAs with implicit completion control.

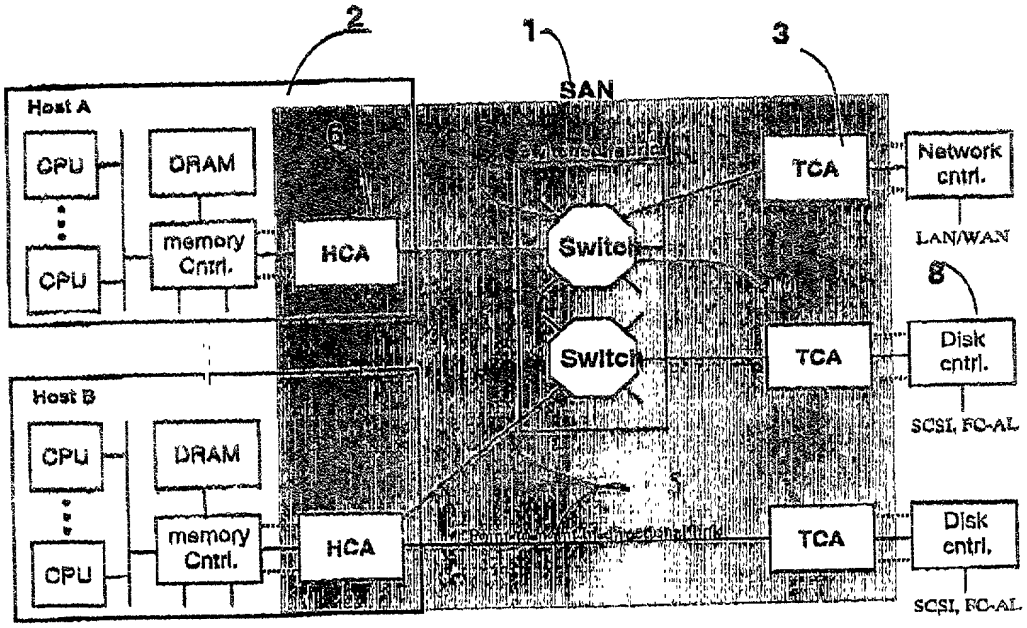


Figure 1. System Area Network

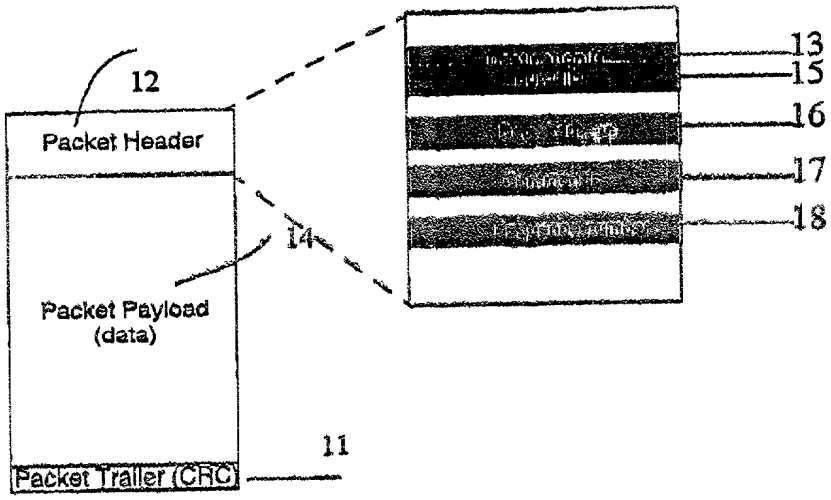


Figure 2. Packet

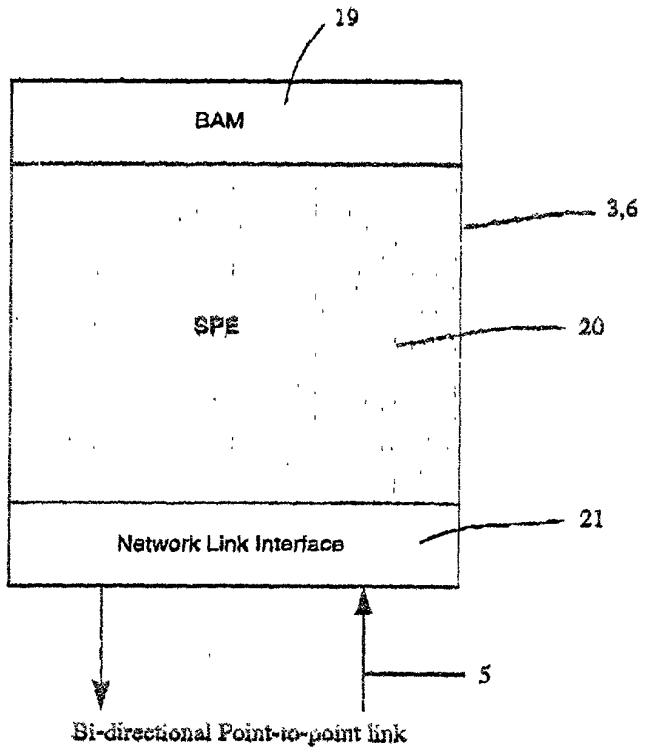


Figure 3. HCA/TCA

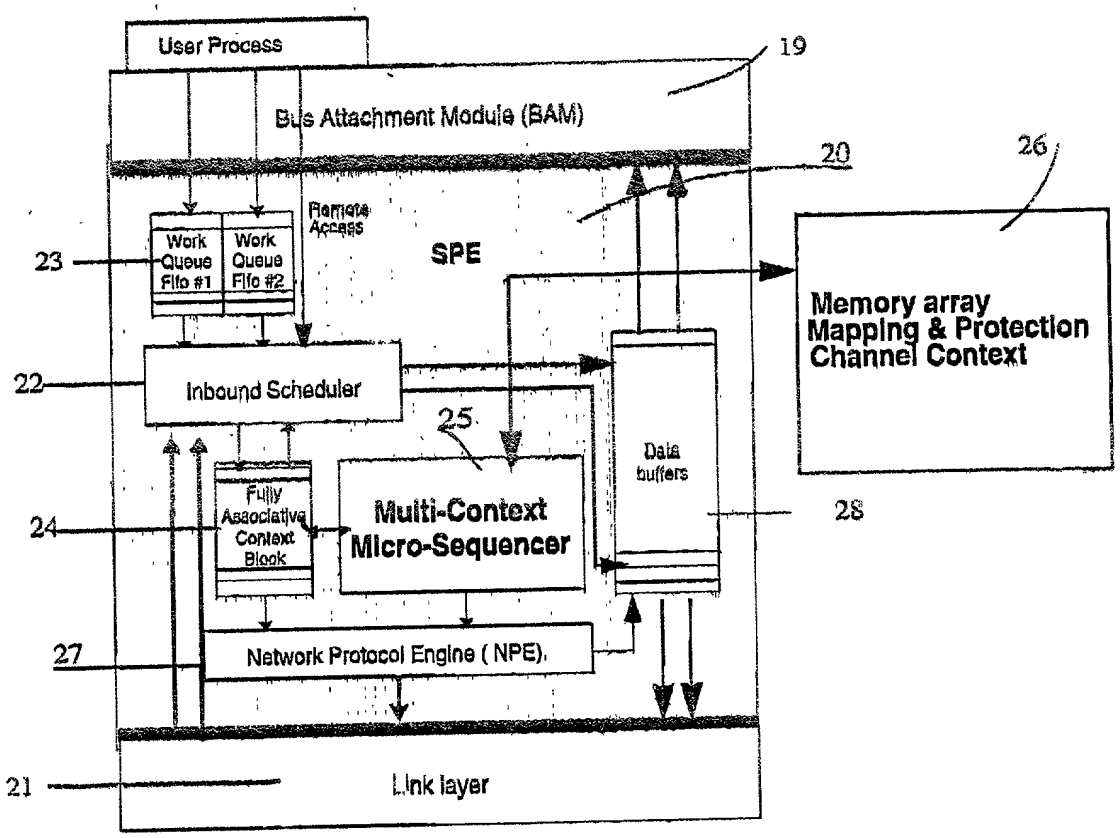


Figure 4. San Protocol Engine

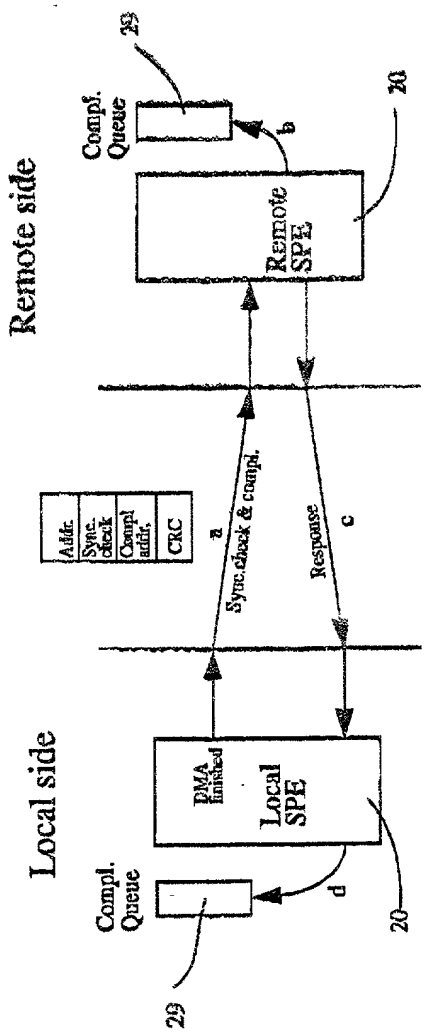


Figure 5. Local and Remote Completion Control

Sak 4

Practitioner's Docket No. U 012642-4 ***PATENT***

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION, OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type:

(check one applicable item below)

[ ] original.
[ ] design.
[ ] supplemental.

NOTE: If the declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

[ ] national stage of PCT.

NOTE: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR C-I-P.

NOTE: See 37 C.F.R. section 1.63(d) (continued prosecution application) for use of a prior nonprovisional application declaration in the continuation or divisional application being filed on behalf of the same or fewer of the inventors named in the prior application.

[ ] divisional.
[ ] continuation.

NOTE: Where an application discloses and claims subject matter not disclosed in the prior application, or a continuation or divisional application names an inventor not named in the prior application, a continuation-in-part application must be filed under 37 C.F.R. section 1.53(b) (application filing requirements-nonprovisional application).

[ ] continuation-in-part (C-I-P).

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

A Computer Netwerk Controller

SPECIFICATION IDENTIFICATION

The specification of which:

(complete (a), (b), or (c))

(a) [ ] is attached hereto.

NOTE: "The following combinations of information supplied in an oath or declaration filed on the application filing date with a specification are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. section 1.63:

"(1) name of inventor(s), and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration on filing;

"(2) name of inventor(s), and attorney docket number which was on the specification as filed; or

"(3) name of inventor(s), and title which was on the specification as filed."

Notice of July 13, 1995 (1177 O.G. 59).

(b) [ ] was filed on _____ as [ ] Application No. _____ or [ ] _____ and was amended on _____ (if applicable).

NOTE: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 C.F.R. section 1.67.

NOTE: "The following combinations of information supplied in an oath or declaration filed after the filing date are acceptable as minimums for identifying a specification and compliance with any one of the items below will be accepted as complying with the identification requirement of 37 C.F.R. section 1.63:

(A) application number (consisting of the series code and the serial number, e.g., 08/123,456);
(B) serial number and filing date;
(C) attorney docket number which was on the specification as filed;
(D) title which was on the specification as filed and reference to an attached specification which is both attached to the oath or declaration at the time of execution and submitted with the oath or declaration; or
(E) title which was on the specification as filed and accompanied by a cover letter accurately identifying the application for which it was intended by either the application number (consisting of the series code and the serial number, e.g., 08/123,456), or serial number and filing date. Absent any statement(s) to the contrary, it will be presumed that the application filed in the PTO is the application which the inventor(s) executed by signing the oath or declaration.

M.P.E.P. section 601.01(a), 7th ed.

(c) [ ] was described and claimed in PCT International Application No. _____ filed on and as amended under PCT Article 19 on _____ *(if any)*.

SUPPLEMENTAL DECLARATION (37 C.F.R. section 1.67(b))

(complete the following where a supplemental declaration is being submitted)

[ ] I hereby declare that the subject matter of the

[ ] attached amendment
[ ] amendment filed on _____

was part of my/our invention and was invented before the filing date of the original application, above identified, for such invention.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, section 1.56.

(also check the following items, if desired)

[ ] and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

[ ] in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 C.F.R. section 1.98.

PRIORITY CLAIM (35 U.S.C. section 119(a)-(d))

NOTE: "The claim to priority need be in no special form and may be made by the attorney or agent if the foreign application is referred to in the oath or declaration as required by section 1.63. The claim for priority and the certified copy of the foreign application specified in 35 U.S.C. section 119(b) must be filed in the case of an interference (section 1.630), when necessary to overcome the date of a reference relied upon by the examiner, when specifically required by the examiner, and in all other situations, before the patent is granted. If the claim for priority or the certified copy of the foreign application is filed after the date the issue fee is paid, it must be accompanied by a petition requesting entry and by the fee set forth in section 1.17(i). If the certified copy is not in the English language, a translation need not be filed except in the case of interference; or when necessary to overcome the date of a reference relied upon by the examiner; or when specifically required by the examiner, in which event an English language translation must be filed together with a statement that the translation of the certified copy is accurate." 37 C.F.R. section 1.55(a).

I hereby claim foreign priority benefits under Title 35, United States Code, section 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

(d) [ ] no such applications have been filed.
(e) [ ] such applications have been filed as follows.

NOTE: Where item (c) is entered above and the International Application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. section 119(a)-(d)

COUNTRY (OR INDICATE IF PCT)	APPLICATION NUMBER	DATE OF FILING DAY, MONTH, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
			[ ]YES [ ]NO
			[ ]YES [ ]NO
			[ ]YES [ ]NO
			[ ]YES [ ]NO
			[ ]YES [ ]NO

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S)
(35 U.S.C. section 119(e))

I hereby claim the benefit under Title 35, United States Code, section 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER	FILING DATE
/	
/	
/	

CLAIM FOR BENEFIT OF EARLIER U.S./PCT APPLICATION(S) UNDER 35 U.S.C. section 120

[ ] The claim for the benefit of any such applications are set forth in the attached ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CONTINUATION-IN-PART (C-I-P) APPLICATION.

ALL FOREIGN APPLICATION(S), *IF ANY*, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

NOTE: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage, or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR C-I-P APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. section 120.

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

(list name and registration number)

JOSEPH H. HANDELMAN, 26179
JOHN RICHARDS, 31053
RICHARD J. STREIT, 25765
PETER D. GALLOWAY, 27885
IAN C. BAILLIE, 24090
THOMAS F. PETERSON, 24790
RICHARD P. BERG, 28145
JULIAN H. COHEN, 20302
WILLIAM R. EVANS 25858
JANET I. CORD, 33778
CLIFFORD J. MASS, 30086
CYNTHIA R. MILLER, 34678

(Check the following item, if applicable)

[ ] I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

[ ] Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO

Ladas & Parry
26 West 61st Street
New York, N.Y. 10023

DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

NOTE: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other document.

NOTE: Each inventor must be identified by full name, including the family name, and at least one given name without abbreviation together with any other given name or initial, and by his/her residence, post office address and country of citizenship. 37 C.F.R. section 1.63(a)(3).

NOTE: Inventors may execute separate declarations/oaths provided each declaration/oath sets forth all the inventors. Section 1.63(a)(3) requires that a declaration/oath, inter alia, identify each inventor and prohibit the execution of separate declarations/oaths which each sets forth only the name of the executing inventor. 62 Fed. Reg. 53,131, 53,142, October 10, 1997.

Full name of sole or first inventor

Helge (Given Name) | (Middle Initial or Name) | Simonsen (Family (Or Last Name))

Inventor's signature (X) Helge Simonsen

Date (X) 14/2-2000 **Country of Citizenship** NORWAY

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Norway

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PAAL (Given Name) | E (Middle Initial or Name) | HAUGSETH (Family (Or Last Name))

Inventor's signature Pål Haugseth

Date 14/2-2000 **Country of Citizenship** NORWAY

Residence STEINSOPPVN 33

Post Office Address 1476 RASTA

NORWAY

Full name of third joint inventor, if any

Helge (Given Name) | (Middle Initial or Name) | (Family (Or Last Name))

Inventor's signature

Date **Country of Citizenship**

Residence

Post Office Address

(check proper box(es) for any of the following added page(s) that form a part of this declaration)

[ ] **Signature** for fourth and subsequent joint inventors. *Number of pages added* _____

* * *

[ ] **Signature** by administrator(trix), executor(trix) or legal representative for deceased or incapacitated inventor. *Number of pages added* _____

* * *

[ ] **Signature** for inventor who refuses to sign or cannot be reached by person authorized under 37 C.F.R. section 1.47. *Number of pages added* _____

* * *

[ ] Added page for signature by one joint inventor on behalf of deceased inventor(s) where legal representative cannot be appointed in time. (37 C.F.R. section 1.47)

* * *

[ ] Added pages to combined declaration and power of attorney for divisional, continuation, or continuation-in-part (C-I-P) application.

[ ] Number of pages added _____

* * *

[ ] Authorization of practitioner(s) to accept and follow instructions from representative.

(If no further pages form a part of this Declaration, then end this Declaration with this page and check the following item)

[ ] This declaration ends with this page.